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AN APPENDIX TO THE SKETCH OF A TOUR
THROUGH SWISSERLAND, CONTAINING

# A
# SHORT ACCOUNT
# OF AN
# EXPEDITION
# TO THE
# SUMMIT
# OF
# MONT BLANC,

BY M. DE SAUSSURE,
OF GENEVA,
IN AUGUST LAST;

IN ORDER TO ASCERTAIN THE HEIGHT OF
THAT CELEBRATED MOUNTAIN, THE LOFTIEST
POINT OF THE THREE ANCIENT
CONTINENTS;

AND

O MAKE A VARIETY OF OBSERVATIONS AND
EXPERIMENTS ON THE FORM AND STRUCTURE
OF THE MOUNTAIN, THE STATE OF
THE AIR, WITH MANY OTHER CURIOUS PARTICULARS.

By Professor T. Martyn.

*L O N D O N:*
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* Thoſe who have already purchaſed the Tour of Swiſſerland, may be ſupplied with this Appendix for ~~One Shilling.~~

6pence —

# ADVERTISEMENT.

TILL the Public ſhall be in poſſeſſion of the detail which M. DE SAUSSURE has promiſed to give of his laſt ſucceſsful and intereſting Expedition to Mont Blanc, in the third volume of his *Voyage dans les Alpes*, hereafter to be publiſhed, this ſhort, but accurate account of it cannot but be acceptable. Allowing the height of the mountain to be 2450 French toiſes, which is our ingenious countryman, Sir George Shuckburgh's menſuration, and agrees very well with M. de Sauſſure's obſervations, the French toiſe being to the Engliſh as 10,000 to 9,383, the height of Mont Blanc in Engliſh meaſure will be three miles all but about 59 yards.

# EXPEDITION

## TO

# MONT BLANC.

AS ſoon as the ſucceſs of Dr. Paccard and Jaques Balmat, in reaching the ſummit of Mont Blanc, related in page 91, was known, M. de Sauſſure, the famous philoſopher of Geneva, came immediately to Chamouni, with the deſign of following their ſteps, but he was prevented, at that time, by a fall of rain and ſnow. He left a commiſſion with Balmat to viſit the mountain from the beginning of June following, and to inform him of the firſt moment when it became acceſſible.

The continual rains prevented M. de Sauſſure from executing his purpoſe, till the firſt of Auguſt laſt: on that day he began his march from the Priory of Chamouni, accompanied by a ſervant and eighteen guides to carry a tent, proviſions, inſtruments, &c.

Though it is ſcarcely two leagues and a quarter, in a right line, from the Priory to the top of the mountain, yet it is a walk of at leaſt 18 hours, becauſe there are difficulties to ſurmount, deviations to make, and about 1920 toiſes to aſcend.

M. de Sauſſure paſſed the firſt night at the top of the mountain of la Côte, ſituated to the ſouth of the Priory, and 779 toiſes above the village. Hitherto there is no trouble or danger, the aſcent is either on turf or on rock, and it is eaſily accompliſhed in 5 or 6 hours.

The ſecond day's journey is not ſo eaſy. Immediately the glacier of la Côte is to be croſſed, in order to arrive at the foot of a little chain of rocks, ſurrounded with the ſnows of Mont Blanc. This glacier is difficult and dangerous; it is croſſed by wide, deep, and irregular crevices, which frequently cannot be paſſed but over bridges of ſnow, ſometimes very ſlight, and ſuſpended over deep abyſſes.

A guide narrowly eſcaped periſhing in one of theſe; he went in the evening with two others to reconnoitre the paſſage; fortunately they had taken the precaution of faſtening themſelves together with cords; the ſnow gave way in the middle of a wide, deep crevice, wherein the man was ſuſpended between his two comrades.

The paſſage of this glacier is ſo difficult, and they were obliged to go about ſo much, that it took them up three hours to gain the firſt rocks of the inſulated chain, though it is no more than a quarter of a league in a right line.

Having reached theſe rocks, they were obliged to quit them directly, in order to aſcend in a ſerpentine line through a valley filled with ſnow, which lies north and ſouth, and extends to the foot of the utmoſt ſummit. This ſnow is traverſed here and there by prodigious openings, ſhewing diſtinctly that the ſnow is diſpoſed in horizontal ſtrata, each ſtratum correſponding with a year. How wide ſoever theſe openings may be, the bottom of them can no where be ſeen.

The guides were deſirous of paſſing the night by one of the rocks, which are met with in the way, but the higheſt of theſe being ſix or ſeven hundred toiſes below the top, M. de Sauſſure was deſirous of making farther progreſs. In order to do this, it would be neceſſary to encamp in the midſt of the ſnow, which he found ſome difficulty in perſuading his companions to come into. They imagined that a cold abſolutely inſupportable reigned among thoſe lofty ſnows, and were ſeriouſly afraid of periſhing by it. M. de Sauſſure told them that he was determined to go on with ſuch as he could depend upon, that he purpoſed to make a deep excavation in the ſnow, which might be covered by the tent; that they might all get under this, and thus preſerve themſelves from the cold, how rigorous ſoever it might be. This arrangement put them into ſpirits, and they went forward.

At four o'clock in the afternoon they reached the ſecond of the three great platforms of ſnow which they were to croſs; there they encamped, 1455 toiſes above the Priory, and 1995 above the ſea, 90 toiſes higher than the pike of Teneriffe. They did not proceed to the higheſt platform, becauſe there they would have been expoſed to the *avalanches*, or falls of ſnow. The firſt, which they had juſt croſſed, is not ſafe from them: they ſaw two which had fallen ſince Balmat's laſt expedition, the ruins covering the valley in its whole extent.

As ſoon as they arrived at the deſtined reſting place, the guides began to form the propoſed excavation, but they very ſoon felt the rarity of the air: the barometer was down to 17 inches, 10 lines $\frac{29}{32}$.

Theſe hardy fellows, to whom the ſeven or eight hours march which they had juſt made, was no ſort of fatigue, had ſcarcely thrown up five or ſix ſpadefuls of ſnow before they were utterly unable to proceed, without reſting every moment. One of them, who went back to fill a barrel with water from one of the crevices, was taken ill in going, returned without water, and was in great pain all the evening. M. de Sauſſure himſelf, who is ſo much accuſtomed to the mountain air, who is always better in it than on the plain, was quite exhauſted with fatigue only in obſerving with his meteorological inſtruments. They were troubled with an inceſſant thirſt, which they had no means of allaying but by melting the ſnow, for the water which they ſaw as they came up was found to be frozen when they returned to it, and the little chafing-diſh which they had with them ſerved twenty thirſty people very ſlowly.

From the midſt of this plain, incloſed by the topmoſt ſummit of Mont Blanc to the South, its lofty ſteps to the Eaſt, and the dome of Gouté to the Weſt, ſcarcely any thing is to be ſeen but ſnow, pure, and of a moſt dazzling whiteneſs, forming on the higheſt pikes a moſt ſingular contraſt with the almoſt black ſky of thoſe exalted regions. No living creature is to be ſeen, no appearance of vegetation; it is the abode of cold and ſilence.

The guides, fearful of cold, cloſed the openings of the tent ſo carefully, that M. de Sauſſure ſuffered ſo much from heat, and air corrupted by reſpiration, as to be obliged to go out during the night, in order to breathe. He found the moon ſhining with moſt aſtoniſhing brightneſs, in the midſt of an ebony ſky, whilſt Jupiter iſſued all radiating from behind the loftieſt pike to the eaſt of Mont Blanc; the light reverberated from this vaſt baſin of ſnows was ſo intenſe, that only ſtars of the firſt and ſecond magnitude were viſible. After this they went to ſleep, but were ſoon awakened by the noiſe of a great *avalanche*, which covered part of the ſteep that they were to climb the next day. As ſoon as it was light they found the thermometer 3° below freezing point.

They ſet out late, becauſe they had ſnow to diſſolve for their breakfaſt, and for their journey;

they drank it almoſt as faſt as it could be diſſolved; and theſe fellows, who did not touch the wine, were continually robbing M. de Sauſſure of the water which he reſerved for his own uſe.

They began this day's march by aſcending to the third and laſt platform, after which, they turned to the left, in order to reach the higheſt rock to the eaſtward of the ſummit. The aſcent is extremely ſteep, in ſome places 39°, every where on the edge of precipices, and the ſurface of the ſnow ſo hard, that they who walked firſt were obliged to hew out their ſteps with a hatchet. They ſpent two hours in climbing this aſcent, which is about 250 toiſes in height. Being now arrived at the laſt rock, they took to the right again, weſtward, in order to mount the laſt aſcent, the perpendicular height of which is nearly 150 toiſes. The inclination of this is only 28 or 29°, and is not at all dangerous, but the air is ſo extremely rare, that their ſtrength was ſoon exhauſted. When they approached the ſummit, M. de Sauſſure could not ſet above 15 or 16 ſteps without taking breath; from time to time he was even ſeized with a kind of fainting, which obliged him to ſit down, but, as the reſpiration returned, he regained his ſtrength, inſomuch that it ſeemed as if he could reach the top of the mountain without ſtopping. All the guides were more or leſs in the ſame ſituation. They were two hours in reaching the ſummit, and it was 11 o'clock when they arrived.

M. de Sauſſure firſt turned his eyes on Chamouni, where his wife and two ſiſters were watching his ſteps with a teleſcope, and had the ſatisfaction of ſeeing the banner wave, which they had promiſed to diſplay as ſoon as their fears were ſuſpended, by diſcovering his ſafe arrival on the higheſt point of the old world.

He then began to enjoy the magnificent ſpectacle which he had in view. A light vapour which hung in the lower regions of the air, concealed the moſt diſtant objects, as the plains of France and Lombardy; but that was little to the purpoſe; he could diſcern with the greateſt clearneſs, all the lofty pikes, whoſe organization he had long wiſhed to be acquainted with. He could ſcarcely believe his eyes, when he ſaw beneath his feet thoſe majeſtic ſummits, from their ſharpneſs called the needles, whoſe very baſes had been of ſo difficult and dangerous acceſs to him before. He could now make himſelf maſter of their relation, their connection, their ſtructure; and one view cleared up what years of labour had not been able to ſolve to his ſatisfaction.

Meanwhile the guides ſet up the tent, and placed the little table, upon which M. de Sauſſure was to make the experiment of boiling water; but when he went to put his inſtruments in order, and to obſerve with them, he was obliged every moment to interrupt his operations, in order to take breath. If we reflect that the barometer was down to 16 inches 1 line, and conſequently that the air was only of about half the common denſity, we ſhall eaſily underſtand that it was neceſſary to ſupply the defect of denſity by more frequent inſpirations. Now this accelerated the motion of the blood, and the more, becauſe the arteries no longer ſuſtained their ordinary preſſure, inſomuch that they were all in a fever.

M. de Sauſſure found, that ſo long as he continued perfectly at reſt, he ſuffered little or no inconvenience, except a ſlight diſpoſition to ſickneſs at the ſtomach; but no ſooner did he exert himſelf, or fix his attention for ſome moments together, eſpecially if in ſtooping he preſſed the thorax, than he was obliged to reſt, and gaſp for two or three minutes. The guides felt the ſame ſenſations. They had no ſort of appetite; their proviſions indeed, being all frozen, were not very inviting; but neither had they the leaſt inclination for wine or brandy, which they perceived increaſed their malady, doubtleſs, by accelerating ſtill more the courſe of the circulation: in ſhort, nothing but cold water did them good, or gave them pleaſure, and both time and trouble were neceſſary to light a fire, without which it was impoſſible to have water.

M. de Sauſſure continued upon the ſummit of Mont Blanc till half an hour paſt three in the afternoon, and though he did not loſe a moment, yet, he could not make all the experiments in four hours and a half, which he has often done in three hours on the ſea-ſhore. He carefully made thoſe, however, which were the moſt eſſential.

The deſcent was much more eaſy than they expected; the motion in going down not compreſſing the diaphragm, does not impede the reſpiration, and they were not forced to ſtop in order to take breath. The deſcent, however, to the firſt platform was very difficult, on account of its ſteepneſs; and the ſun lighted up the precipices below ſo brilliantly, that it required a good head not to be terrified. They repoſed again on the ſnow, but 200 toiſes lower than the preceding night. They were now ſatisfied that it was the rarity of the air which had incommoded them on the ſummit, for, if it had been fatigue, they muſt have found themſelves worſe after this long and troubleſome deſcent, whereas they now ſupped with a good appetite; and M. de Sauſſure made his obſervations without any inconvenience. He aſſigns 1900 toiſes as the height at which he begins to be incommoded.

The day after they found the glacier of la Côte changed by the heat of theſe two days, and more difficult to croſs than when they aſcended it. They were obliged to deſcend a plain of ſnow, which had an inclination of 50°, in order to avoid a crack, which had opened during their expedition. At half an hour paſt 9 *a. m.* they arrived on the mountain of la Côte, not a little rejoiced at finding themſelves on firm ground, and they returned to the Priory by dinner-time. They all got there ſafe and ſound, with their eyes and faces uninjured, which was owing to their having put black crape over their faces; whereas, they who had gone up before them, returned almoſt blind, and with their ſkin terribly burnt by the reflection of the ſnow.

## *Some Account of the Obſervations and Experiments made on the Summit of Mont Blanc the 3d of Auguſt,* 1787.

1. *Form of the ſummit.* There is no plain, but it is a long ridge, nearly horizontal in the moſt elevated part, in a direction from Eaſt to Weſt, and deſcending in an angle of from 28° to 30°. On the ſouth-ſide the ſlope is only 15° or 20°, but on the North 45° or 50°.

This ridge is ſo narrow, that two perſons cannot walk a-breaſt on it; but it is more rounded towards the Eaſt, and towards the Weſt it is like the gable-end of a houſe, projecting northwards. The ſummit is entirely covered with ſnow, nor is any rock to be ſeen, till 60 or 70 toiſes lower.

2. *Snow.* The ſurface is ſcaly, covered in ſome places with a varniſh of ice; it is of a firm conſiſtence, but a ſtick may be driven in with ſome force. The ſlopes are covered with a frozen cruſt of ſnow, which often breaks, and under it is a ſoft ſnow without coherence.

3. *Rocks.* The higheſt are all of granite, thoſe on the eaſt-ſide are mixed with a little ſteatites or ſope-rock; on the South and Weſt they contain much ſchorl, and a little horn-ſtone. One of the higheſt to the eaſtward has the ſtrata very diſtinct, and nearly vertical. The higheſt of all are two little rocks of granite, very near each other, to the eaſtward of the ſummit, and 60 or 70 toiſes below it. It is plain that the loftieſt of the two has been lately ſhattered by lightning, fragments of it being ſcattered on every ſide on the freſh-fallen ſnow, to the diſtance of ſeveral feet. The lower rock is in form of a horizontal table, with a poliſhed ſurface: the upper ſide is buried in the ſnow, but the lower, or eaſt ſide

is 4 feet, 8 inches, 6 lines above the ſurface of the ſnow. This may ſerve hereafter to aſcertain whether the ſnow increaſes or diminiſhes.

4. *Animals.* The only animals that were ſeen, were two of the butterfly kind; one was a little gray moth, which croſſed the firſt platform: the other was a butterfly, which ſeemed to be the *Myrtillus*; it traverſed the higheſt ſlope of the mountain about 100 toiſes below the ſummit, and probably had been forced thither by the winds.

5. *Vegetables.* The laſt plant with viſible flowers which appeared, was the *Silene acaulis*. M. de Sauſſure found a tuft of it in flower, in the rock near which he lay at his return, about 1780 toiſes above the ſea; but he obſerved little tuberculated lichens upon the very higheſt rocks: among others the *ſulphureus* and *rupeſtris* of Hoffman.

6. *Barometer.* M. de Sauſſure had three of theſe inſtruments with him; one he left with

his ſon, at the Priory of Chamouni, in order for him to make correſpondent obſervations to thoſe which he was to make on the mountain, as well as to thoſe which M. Senebier had undertaken to make at Geneva: the two others he took with him up the mountain, that they might reciprocally correct each other. The 3d of Auguſt, at noon, three feet below the ſummit, they were at 16 inches and $\frac{144}{160}$ of a line: proper corrections being made for the condenſation of the mercury by cold, and the ſmall difference which there was between the two inſtruments. At the ſame inſtant M. Senebier's barometer at Geneva, was at 27i. 2l. $\frac{1085}{1600}$. The thermometer in the ſhade, on Mont Blanc, was at 2°, 3 below freezing point, and at Geneva, 22, 6 above it. If from theſe relative heights of the barometer and thermometer, we calculate the height of the mountain according to the formula of M. de Luc, we ſhall find it to be 2218 toiſes above M. Senebier's ſtudy: and 2272 according to that of M. Trembley. To this height we muſt add that of M. Senebier's bier's ſtudy above the lake of Geneva, that is 13 toiſes. The height of Mont Blanc, therefore, above the lake, will be 2231 toiſes, according to the firſt formula, and 2285 according to the ſecond. Now the trigonometrical menſuration of Sir George Shuckburgh, which exceeds that of M. Pictet, by 19 toiſes, gives a medium height between theſe two, namely, 2257 toiſes above the lake of Geneva. Here then, as in other caſes, the formula of M. de Luc diminiſhes too much the height given by logarithms, and, if in this caſe, the formula of M. Trembley does not diminiſh it enough, the reaſon is plain: the air in the upper part of Mont Blanc is much colder than on other mountains, on account of the ſnow and ice ſurrounding it almoſt to its baſe; it requires, therefore, a correction ſomewhat greater than other mountains.

The reſult of an obſervation, made by M. de Sauſſure's ſon, approaches ſtill nearer to Sir George Shuckburgh's menſuration, when calculated by M. Trembley's formula. A ſecond obſervation, which M. de Sauſſure himſelf made on the mountain at 2 o'clock, did not differ ſenſibly from the firſt. We may conclude, therefore, that Mont Blanc is nearly of the height aſſigned it by Sir George Shuckburgh, namely 2450 toiſes above the ſea.

7. *Thermometer* of mercury, with the ball insulated, ſuſpended 4 feet above the ſummit, at noon, in the ſun, was — 1, 3; at the ſame height, in the ſhade of the frame from which it hung, it was — 2, 3: another thermometer, whoſe ball was painted black, was + 1, 9.

At 2 *p. m.* in the ſame place, that in the ſun was — 1, 3; that in the ſhade — 2, 5, and the black one, in the ſun, + 1, 9.

8. *Hygrometer.* He had two; by incloſing them in a moiſtened box, they came, as on the plain, to their term of extreme humidity: he then placed one in the ſun, and the other in the ſhade. At noon, the firſt was at 44, the ſecond at 51. This difference is much greater than it uſually is on the plain. At 3 *p. m.* that in the ſun was at 46; that in the ſhade at 52.

At Geneva the hygrometer at noon was 76, 7; at the Priory 73, 4.

“Hence it follows, that the air was ſix times leſs moiſt than at Geneva; for by M. de Sauſſure's tables (ſee *Eſſais ſur l'Hygrometrie*, §. 180) a foot cube of air, at the temperature of —2, 6, and at the degree of dryneſs 57°, contains only 1 grain $\frac{7}{10}$ of water reduced to vapour; whereas, at the temperature 22, 6, and the degree of dryneſs 76, 7, it contains rather more than 10 grains. This extreme dryneſs of the air was undoubtedly one cauſe of the violent thirſt which they endured.

9. *Electrometer*. The balls diverged three lines; the electricity was poſitive. M. de Sauſſure was ſurpriſed not to find it ſtronger; but obſerves, that it probably proceeded from the great dryneſs of the air.

10. *Boiling of water*. Water boiled at 68°, 993 of a thermometer, armed with a micrometer in which the mercury riſes to 80° when the barome-

ter is at 27 inches. The water was in a kettle, heated by a ſpirit lamp, on Mr. Argand's principles. It required half an hour on the mountain to make water boil, whilſt at Geneva it would boil in 15 or 16 minutes, and by the ſea-ſide in 12 or 13. Water acquired at the ſea-ſide, the 22d of April, this year, in the ſame apparatus, a heat equal to 81°, 299; the barometer corrected being 28 inches 7 lines $\frac{92}{100}$, which makes a difference of 12°, 306.

11. *Colour of the ſky.* M. de Sauſſure dyed paper with 16 ſhades of blue, marking the deepeſt No. 1, and the paleſt No. 16; from each of theſe he cut off three equal ſquares, and thus forming three ſuites of ſhades perfectly alike, he left one with M. Senebier, a ſecond with his ſon, and took the third with him. The third of Auguſt, at noon, the ſky in the zenith at Geneva, appeared of the 7th ſhade, at Chamouni between the 5th and 6th, and on Mont Blanc between the 1ſt and 2d, that is, of the deepeſt garter blue.

12. *Wind.* It blew from the North, and on the ſummit incommoded them by its coldneſs; but if they deſcended ever ſo little on the ſouth ſide, they did not feel it at all, but enjoyed ſo temperate a climate, that moſt of the guides ſlept, or reſted themſelves on their ſacks extended along the ſnow.

13. *Declination of the magnetic needle*, the ſame as at the Priory.

14. *Lime Water*. M. de Sauſſure mixed ſome of it with an equal quantity of diſtilled water; he then filled two ſmall glaſſes, which he ſet on the ſummit, at a diſtance from the place which they occupied, taking care not to breathe on them. On inſpecting them an hour and three-quarters afterwards, he found a coloured pellicle on the ſurface, which began to freeze at the edge. By the ſea-ſide a much thicker pellicle would have been formed in the ſame time.

15. *Cauſtic Alkali.* He dipped ſtrips of

paper in vegetable cauſtic alkali, prepared with the utmoſt care; in coming out of the bottle they made no ſort of effervescence with acids; but after being expoſed an hour and a half on the ſummit of the mountain, they became dry, and then made a very conſiderable effervescence. Theſe two experiments aſcertain that the air of the atmoſphere, at this height, is ſtill mixed with fixed air.

16. *Shadows*. Colourleſs.

17. *Smell* and *taſte*, ſubſiſted in all their perfection: they found univerſally the ſame ſmell and taſte in their wine and proviſions, as at the foot of the mountain.

18. *Sound*. A piſtol fired on the ſummit was no louder than a cracker let off in a room.

19. *Rate of the pulſe*. After they had been four hours on the top of the mountain, Balmat's pulſe made 98 pulſations in a minute; M. de Sauſſure's ſervant's, 112, and M. de

Sauſſure's, 100. At Chamouni, they beat in the ſame order, 49, 60, 72.

20. *Relative height of Mont Blanc.* The loftieſt points they could diſcover were the *Schreckhorn* in the Grindelwald, and *Monte Roſa* in Piedmont. M. de Sauſſure ſaw each of them under an angle of 30′ below the horizon: now, allowing for the ſinking of the true level below the apparent one, this angle leaves a decided ſuperiority in height to Mont Blanc.

P. S. Several perſons having aſked M. de Sauſſure whether he diſcovered the ſea from the top of Mont Blanc, he had the curioſity to examine whether it was poſſible. The height of this mountain being 2450 toiſes, allowing for refraction, the ſummit ought to be viſible at the diſtance of 126,600 toiſes, or 63 French leagues. Refraction increaſes this diſtance about 5 leagues, the mountain, therefore, ſhould be viſible 68 leagues off. Now the ſhore of the Gulph of Genoa, which is the neareſt ſea to Mont Blanc, is diſtant 112,000 toiſes. Not only the ſea-ſhore, therefore, would be viſible, but 12 leagues beyond, if there were nothing but plains between, and if we could diſtinguiſh ſea from land at the diſtance of 56 leagues, which hardly ſeems probable; but the whole gulph being flanked by high mountains, it is impoſſible, on that account, to diſcover the ſea. The mountains themſelves may be ſeen, and M. de Sauſſure thinks he could diſtinguiſh Mont Blanc from the mountain of Caume, two leagues to the North of Toulon, but then this mountain is 400 toiſes above the level of the ſea.

M. BOURRIT, incited by the ſucceſs of M. de Sauſſure, was determined to be the firſt who ſhould execute another difficult enterprize, namely, the croſſing directly by the valley of ice of the Montanvert, from Chamouni into Piedmont. Accordingly, on the 27th of Auguſt laſt, he, with his ſon and two guides, lay on the Montanvert. The next day they walked twelve hours on the ice, and deſcended to Cormayeur in five hours and a half, having been in imminent danger from a fog and intenſe cold. The 29th they proceeded to the capital of the Val d'Aoſt, and on the 30th they aſcended the mountain of St. Bernard, deſcending on the other ſide below the Hoſpice, to the bourg of St. Pierre. On the 31ſt they went to Martigni, mounted the Trient, and the Col de Balme, and ſo returned to Chamouni; all which was a walk of 15 hours.

THE END.